SAMPLE QUESTION PAPER

BLUE PRINT

Time : 2 Hours **Max. Marks :** 35

S. No.		Chapter	Section-A (2 marks)	Section-B (3 marks)	Section-C (5 marks)	Total
8.	Unit-V	Electromagnetic Waves	–	1(3)*	–	5(17)
9.	Unit-VI	Ray Optics and Optical Instruments	–	2(6)#	–	
10.		Wave Optics	–	1(3)	1(5)	
11.	Unit-VII	Dual Nature of Radiation and Matter	1(2)#	1(3)	–	4(11)
12.	Unit-VIII	Atoms	–	1(3)	–	
13.		Nuclei	–	1(3)	–	
14.	Unit-IX	Semiconductor Electronics : Materials, Devices and Simple Circuits	2(4)	1(3)	–	3(7)
		Total Questions	**3(6)**	**8(24)**	**1(5)**	**12(35)**

*It is a choice based questions.

#Out of the two or more questions only one question is choice based.

Time : 2 Hours *Max. Marks : 35*

General Instructions :

(i) There are 12 questions in all. All questions are compulsory.

(ii) This question paper has three sections: Section A, Section B and Section C.

(iii) Section A contains three questions of two marks each, Section B contains eight questions of three marks each, Section C contains one case study-based question of five marks.

(iv) There is no overall choice. However, an internal choice has been provided in one question of two marks and two questions of three marks. You have to attempt only one of the choices in such questions.

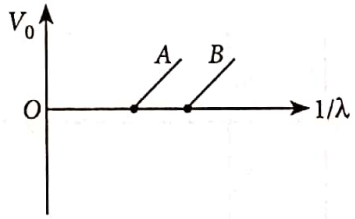
(v) You may use log tables if necessary but use of calculator is not allowed.

SECTION - A

1. Explain, how the heavy doping of both p and n-side of a p-n junction diode results in the electric field of the junction being extremely high even with a reverse bias voltage of a few volts.

2. What is the conductivity of a semiconductor sample having electron concentration of 5×10^{18} m^{-3}, hole concentration of 5×10^{19} m^{-3}, electron mobility of 2.0 $m^2 V^{-1} s^{-1}$ and hole mobility of 0.01 $m^2 V^{-1} s^{-1}$? (Take charge of electron as 1.6×10^{-19} C)

3. Figure shows the stopping potential (V_0) for the photo electron versus ($1/\lambda$) graph, for two metals A and B, λ being the wavelength of incident light. How is the value of Planck's constant determined from the graph?



OR

Write two main observations of photoelectric effect experiment which could only be explained by Einstein's photoelectric equation.

SECTION - B

4. Write three characteristic properties of nuclear force.

5. A parallel beam of light of wavelength 600 nm is incident normally on a slit of width d. If the distance between the slits and the screen is 0.8 m and the distance of 2nd order maximum from the centre of the screen is 15 mm. Find the width of the slit.

6. A diatomic molecule is made of two masses m_1 and m_2 which are separated by a distance r. Calculate its rotational energy by applying Bohr's rule of angular momentum quantization.

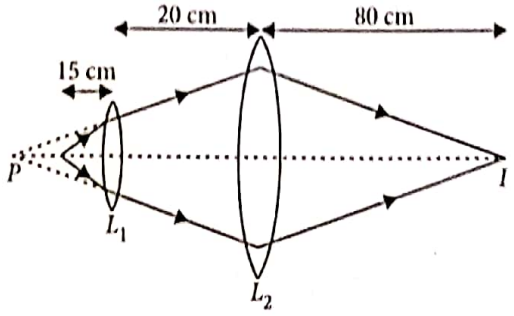
7. A ray of light passing from air through an equilateral glass prism undergoes minimum deviation when the angle of incidence is $\frac{3}{4}$ of the angle of prism. Calculate the speed of light in the prism.

OR

Draw a ray diagram to show the image formation of a distant object by a refracting telescope. Write th expression for its angular magnification in terms of the focal lengths of the lenses used.

8. An electron and a photon each have a wavelength 1.00 nm. Find
   (i) their momenta,
   (ii) the energy of the photon and
   (iii) the kinetic energy of electron.

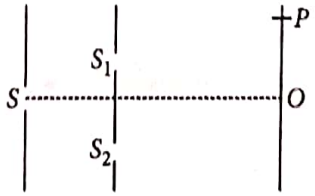
9. In the following diagram, an object 'O' is placed 15 cm in front of a convex lens L_1 of focal length 20 cm and the final image is formed at I at a distance of 80 cm from the second lens L_2. Find the focal length of the lens L_2.



10. Answer the following questions:
   (i) Show, by giving a simple example, how *e.m.* waves carry energy and momentum.
   (ii) How are microwaves produced? Why is it necessary in microwave ovens to select the frequency of microwaves to match the resonant frequency of water molecules?
   (iii) Write two important uses of infrared waves.

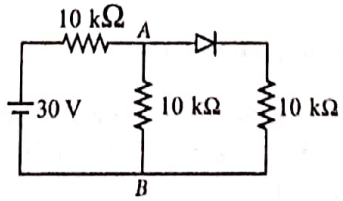
OR

In a modified set-up of Young's double slit experiment, it is given that $SS_2 - SS_1 = \lambda/4$, *i.e.* the source 'S' is not equidistant from the slits S_1 and S_2.



   (a) Obtain the conditions for constructive and destructive interference at any point P on the screen in terms of the path difference $\delta = S_2P - S_1P$.
   (b) Does the observed central bright fringe lie above or below 'O'? Give reason to support your answer.

11. In the given figure, find the potential difference between A and B.

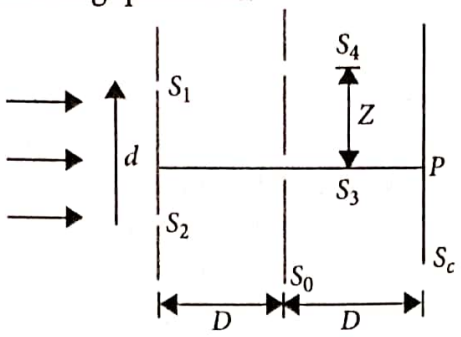


SECTION - C

12. CASE STUDY : SOURCES OF LIGHT

Consider the situation shown in figure. The two slits S_1 and S_2 placed symmetrically around the central line are illuminated by monochromatic light of wavelength λ. The separation between the slits is d. The light transmitted

by the slits falls on a screen S_0 place at a distance D from the slits. The slits S_3 is at the central line and the slit S_4 is at a distance from S_3. Another screen S_c is placed a further distance D away from S_c.
Based on the above facts, answer the following questions:



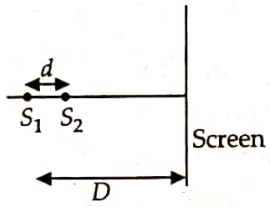
(i) Find the path difference if $z = \frac{\lambda D}{2d}$.

(a) λ (b) $\lambda/2$ (c) $3/2\lambda$ (d) 2λ

(ii) Find the ratio of the maximum to minimum intensity observed on S_c if $z = \frac{\lambda D}{d}$

(a) 4 (b) 2 (c) ∞ (d) 1

(iii) Two coherent point sources S_1 and S_2 are separated by a small distance d as shown in figure. The fringes obtained on the screen will be



(a) concentric circles (b) points (c) straight lines (d) semi-circles.

(iv) In the case of light waves from two coherent sources S_1 and S_2, there will be constructive interference at an arbitrary point P, if the path difference $S_1P - S_2P$ is

(a) $\left(n+\frac{1}{2}\right)\lambda$ (b) $n\lambda$ (c) $\left(n-\frac{1}{2}\right)\lambda$ (d) $\frac{\lambda}{2}$

(v) Two monochromatic light waves of amplitudes $3A$ and $2A$ interfering at a point have a phase difference of 60°. The intensity at that point will be proportional to

(a) $5A^2$ (b) $13A^2$ (c) $7A^2$ (d) $19A^2$